Jam Experiment Dance Interact – Towards a Participatory Electronic Dance Music Environment

Rene Wooller[1], Richie Allen[2], Matt Petoe[3], Andrew Strelnikov[4] and Brendan Wright[5]

[1]Creative Industries. Music Queensland University of Technology
Kelvin Grove 4059
r.wooller@qut.edu.au

[2]Richie's Electronic Playground
po box 5922
West End 4101
richie@r32d.com

[3]School of ITEE University of Queensland
St Lucia 4072
mattp@ihug.co.nz

[4]Freelance Design
andyrusky@hotmail.com

[5]Creative Industries Queensland University of Technology
Kelvin Grove 4059
b.wright@qut.edu.au

ABSTRACT

This article reports on the current state of a participatory electronic dance music project called Jam Experiment Dance Interact (J.E.D.I.). The fundamental aims and problems are introduced, leading into some discussion of design. Various individual interfaces and the relevant hardware, electronics, software, mappings and music are then examined. Possibilities for future developments are also mentioned. The report ends with a summary of partial solutions to key problems offered by J.E.D.I.

Keywords

Interactive, Jam, Electronic Dance Music, Participation

INTRODUCTION

Aiming to provide a more interactive and participatory alternative to status quo electronic music delivery, the J.E.D.I. team has been designing and building new musical interfaces since July 2004. The project was motivated by a desire to communicate the joys of jamming to a wider public as well as an interest in the potential of new technology, electronic music and new forms of collaboration. Experimental developments have occurred on a number of levels including design, software, electronics, mechanics and overall system integration.

A number of musical interfaces have been designed and built, despite initial problems. Recent developments communicate via the Musical Instrument Digital Interface (MIDI) protocol [1] to a central software music system called LEMu (Live Electronic Music). The program interprets their controls using a combination of pre-prepared patterns as well as a variety of generative and transformational algorithms to create a stream of MIDI output that is rendered into audio using a synthesiser. More detailed explanations of LEMu already exists [2, 3]. Additional features coded specifically for J.E.D.I. are described as needed.

Testing has occurred throughout the project in the form of gigs at various music festivals. Questions, observations and audience feedback have generated a number of ideas for improvements in usability, mappings, system design and music.

Some fundamental problems have become clear:

1. How can mostly non-musicians create aesthetically pleasing music?
2. How can a system guide collaboration so as to maintain a balance between team-based musicality and personal expression?
3. How can groups that are a few times larger than the number of parts in a piece of electronic music exert a satisfying level of control over the music?

4. It is possible to achieve interactive socio-musical experiences of a similar nature to traditional acoustic jams on a centralised loudspeaker system?

The current developments have attempted to address these problems in various ways. While each has their own strengths and weaknesses, a number of possible future strategies that are likely to be more effective are yet to be implemented.

J.E.D.I. DESIGN PRINCIPALS

Applying Previous Approaches

J.E.D.I. design principals are in some cases sympathetic and in other cases contrary to other well-known interface design ideologies, namely Cognitive Ergonomics and Bauhaus.

Louis Sullivan's famous advice: "form follows function" [4], is a relevant and useful approach, especially when considering practical aspects such as the integration of electronic and mechanical components. However, the *function* of a novel musical interface is to control a certain musical *form*. Upon recognition of this paradox, more holistic approaches to music interface design were experimented with. It was found that if an overall character or theme for a device is decided upon, it acts as useful framework for rapid generation of coherent musical, visual and haptic ideas. However, this sometimes led to simplistic clichés and was partially abandoned in favour of more complex approaches.

The field of Cognitive Ergonomics is particularly relevant to human-machine interfaces such as in J.E.D.I.. Shakel [5] states that there are four aspects which contribute to the overall usability of an interface that should be considered:

1. **Learnability:** the amount of learning necessary to achieve tasks
2. **Ease of Use:** the efficiency and effectiveness with which one can achieve these tasks
3. **Flexibility:** the extent to which a system can adapt to new tasks and environment requirements
4. **Attitude:** the positive or negative attitude of the use towards the system

Despite the generalisability and usefulness of this ergonomic framework, it is difficult to imagine music and jamming as a "task". As well as this, the social/collaborative intent of J.E.D.I. can sometimes act in opposition to standard ergonomic concepts. For example, having the controls of a workstation in a semi-circle with a single user at the centre maximises the accessibility of various control zones which are also visually easier to distinguish when converging on the user from multiple directions. However, this is at odds with the notion of a circular control desk with multiple users surrounding it (Figure 19 b.). Although individual ergonomics on a table is reduced, social exchanges and shared control may be better facilitated.

More recent evaluation methods are better suited to musical expression [6], but with only a minor focus on the joys of social music making.

The basis for alternative extensions (see Jamability below) more specific to enjoyment of collaborative musical interfaces began to evolve naturally and was hence adopted.

Jamability

Jammier by Design

In order to achieve a successful participatory electronic music experience, musical participation should be enabled and encouraged in every element of design: environment, physical interface, mapping, music and sound. In general, approachability, interest and functionality seem to be the primary attributes needed of each element to contribute to the overall *jamability*. However, the J.E.D.I. design process is not an exact science, and semi-random experimentation is also an important part of our approach, providing insights and stimulus for further developments.

In general, design of the overall environment requires little effort. The positioning of instruments according to spatial characteristics, function, capabilities, acoustics and their relationship to other devices is a sensible, semi-intuitive process. Most electronic dance music venues are already designed to encourage *physical* participation through being musically immersive, visually stimulating as well as open and comfortable.

However, when it comes to *musical* participation, the seemingly omnipotent sound system makes it difficult to attach sound to gesture and communicate musically, due to the absence of directional sonic feedback (Figure 1 a.).

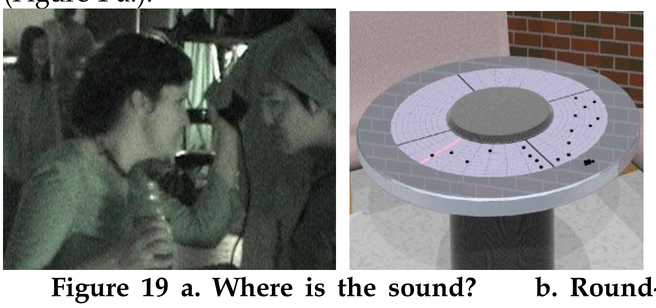

Figure 19 a. Where is the sound? b. Round-Table Sequencer

Ultimately, a parallel stream of audio for each part seems necessary, whether synthesised locally, or from a central processor such as a computer with a multi-output soundcard. If it is impractical to incorporate speakers with the necessary amplitude and frequency response within devices themselves, fold-back speakers could be deployed.

To further encourage interactions the music itself can be designed appeal to the target audience and their notion of approachability, interest and functionality. At the Electrofringe festival [7] for example, it was observed that the extremely heavy form of hardcore jungle that was playing previous to us and which we mixed into, was only accessible and interesting to a small portion of the crowd. Functionally, this music seemed useful only for extremely agitated dancing. Most people were not inclined to dance, which meant less interaction, particularly with the floor-pads. As the tempo was brought down to a more relaxed level, people tended to approach the devices in an inquisitive manner.

2.2.1 Social and Expressive Jamming

For conceptualising design it was sometimes useful to define two general forms of musical exchange: social and expressive. The enjoyment of social jamming stems from communication and in some cases teamwork. For example, exchanging, listening and reflecting sympathetic musical ideas or being part of a team that is creating and maintaining a musical structure. The enjoyment of expressive jamming occurs when the desire to externalise various emotions is being fulfilled through making music. During a jam, conflicting music can arise when the people involved are motivated by different forms of enjoyment. An obvious example is when an individual who is enraptured in expressing themselves does not pay attention to the musical structure that a team of other players are attempting to maintain.

Design of the interfaces, music, mappings and spatial aspects can all be employed to reduce the "collateral damage" these forms of enjoyment can inflict upon one another. Expressive devices, such as the Seuss Stick, that are designed for a single user can be assigned a transient, rather than pivotal musical role. Another approach is to constrain the music so that it is more complementary – for example, tonality constraints and rhythmic quantisation is applied from within LEMu. Yet another technique is to hypnotise the user with visual effects (see Hypnonoodle), so as to induce a more cerebral approach to music making.

Social-jamming interfaces seem to work well when musical communication [8] and/or shared structural control [9] are encouraged. Perhaps to experiment with the limits of this idea, our multi-user devices were designed to maintain expressive capabilities through minimal constraints and avoidance of structural control. This is evident in the Floor Percussion Pads, Pressure Sensitive Tiles and to a lesser extent Hypnonoodle (all described below). When applying such devices to untrained participants chaotic music is inevitable, especially in the first half-hour, although it tends to settle with time as people familiarise themselves. A multi-user interface for controlling musical structure such as the Round-Table Sequencer (Figure 19 b.) is planned for development in the future to more fully explore the social aspects of jamability.

DEVELOPMENT

Overall System

J.E.D.I. is an amalgamation of a small number of parallel systems described in more detail below. While some interfaces such as the Percussive Floor Pads and Hypnonoodle transmit MIDI information to dedicated synthesizers, a number of MIDI devices including the Seuss Stick and Pressure Tiles can be mapped to parameters in the LEMu software (Figure 20 LEMu-Based System) which uses various algorithms to create a stream of musical MIDI data. This data is rendered into audio using Reason [10], with MIDI-Yoke [11] used as an internal router. The laptop and other audio sources are patched into a mixing desk and sent through the central speaker system.

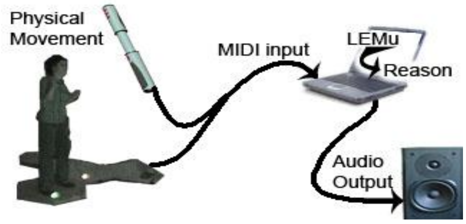

Figure 20 LEMu-Based System

Musical Interfaces

Hypnonoodle Instrument

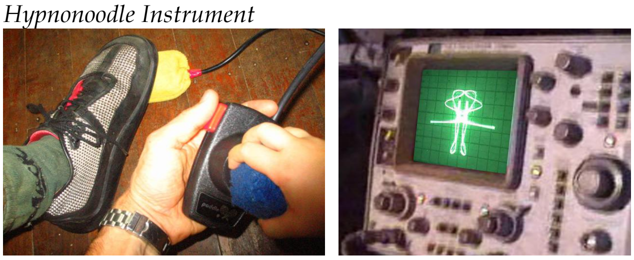

Figure 21 Hypnonoodle Interface and Feedback

The Hypnonoodle sound toy is a simple but fun, very addictive audio-visual instrument. Two separate simple audio instruments are controlled by a physical interface consisting of a rotary potentiometer with pushbutton, and a Force-Sensing Resistor [12] located in a foot pedal. CV information from each device is converted to MIDI - driving a patch programmed into a Nord Micromodular synthesizer.

One instrument controls the filter cut-off on a bass drone sound in response to foot pressure, while the other is pitch quantised to slide along a Lydian mode in tune with the drone as the dial on the paddle controller is moved.

The audio waveform of each sound source is plotted against the other using the x-y function of an oscilloscope showing a very intuitive representation of what's going on a waveform level – particularly highlighting harmonies between the two instruments.

Hypnonoodle is quite mesmerising, musical, highly learnable and easy to use. This is balanced by low flexibility due to the simplistic design of interface and direct mappings.

In practice we found the furry cover put on the foot pedal encouraged a positive attitude towards the device. Some people stroked it like a pet – creating an unexpected new mode of play.

Seuss Stick

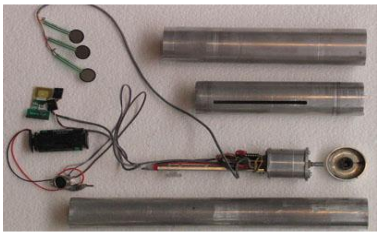

Figure 22 Exploded View of Seuss Stick

The Seuss Stick is a single-user MIDI instrument designed for live improvisation with LEMu. It is constructed from telescopic tubes of aluminium, the action of which is similar to a bicycle pump. Controls for the Seuss Stick consist of three Force-Sensing Resistors (FSRs) [12], used as analogue pushbuttons, one sliding potentiometer, and a rotary potentiometer. Inside the Seuss Stick we employ a Microchip PIC16F88 microcontroller [13] to sample the analogue voltage from each control at a 10 bit resolution. In version one, this was downsampled to 7 bits, parsed into a MIDI message, and sent to LEMu via a MIDI cable.

Seuss Stick version two (Figure 22 Exploded View of Seuss Stick) is wireless, communicating with the central computer by means of a nRF2401A GFSK data transceiver [14]. Data is no longer transmitted in the MIDI format, instead being parsed at the receiving end. This means the full 10 bit accuracy is available to LEMu if required.

The interface is ergonomic and flexible; however it has been difficult to design a set of mappings that is learnable. Altering the compositional parameters of a software meta-instrument (LEMu) seemed too abstract and unrelated to the gestures for most people at the gig [15] to understand. Simpler mappings may help, although the presence of five analogue controls immediate adds complexity to interaction. The aforementioned "omnipotent" sound system may have also interfered with learning.

The circuitry design is a modular arrangement which offers much potential for future developments. The nRF2401A transceiver is programmable; each unit can be given a unique digital address, theoretically enabling a network of wireless controllers. LEMu software can communicate to individual addresses, and thus would be capable of streaming feedback information to each user.

Air Whammy Accelerometer

Figure 23 Air Whammy

The Air Whammy is a 2-axis accelerometer (+- 2g) that was originally an analogue device driving filter cut-off. For a thorough evaluation see [6]. In practice, the accelerometer was often used in only one axis as people were generally not able to distinguish the separate effect of each. Recently adapted as a 2 axis MIDI controller, a MIDI processor has been added to LEMu for calculating absolute acceleration in the X-Y plane with further potential to integrate controller values to obtain an estimate of velocity and position information. It is an intuitive interface with imprecise control and low flexibility. These characteristics seem to encourage an expressive style of jamming.

Percussive Floor Pads

The Percussive Floor Pads consist of modular foam play-mats with contact microphones embedded in the centre of each tile. The contact mics are connected to a Roland PM-16 drum brain which sends MIDI velocity note data to an AKAI sampler loaded with percussive sounds and themed samples to match the setting.

Combining expressive control and untrained participants tended towards chaotic music. However, these pads were useful in their ability to engage many people at once.

Interestingly, the small trigger points on the floor were more conducive to playing rhythm with hands than feet (Figure 24).

Figure 24 Floor Percussion pads

We subsequently developed large tiles that measure continuos pressure, rather than requiring the dancer to hit a small area.

Pressure Sensitive Tiles

Figure 25 Pressure Sensitive Tiles

Modular in construction, these tiles provide one to one MIDI controller information based on the load placed on them in addition to providing visual feedback with a bright LED.

With the original one to one mapping of weight to controller data such as filter cut-off or pitch range, slow weight shifting seemed to be the most effective control technique. However, tests in live situations demonstrated that for many people the initial approach is to bounce vigorously from one tile to another. When jumping, one tends not to think about the bend position of the tile so much as the force or velocity that is being applied. Considering this, we developed a MIDI processing module within LEMu to differentiate the controller output – allowing the velocity of the bounce to be used. We also found people often stare down at the LED so alternative feedback techniques such as localised audio and/or spotlights are currently sought.

CONCLUSION

This report had presented the current developments and primary concepts behind J.E.D.I.. In general the project has enabled and encouraged electronic dance music audiences to participate musically, however there are many issues to deal with before this can happen on a substantial scale.

The fundamental problems raised in the introduction have been partially addressed:

Non-musicians tend not to produce aesthetically pleasing music when using expressive interfaces and are easily overwhelmed by flexibility. Simplicity, constraints and involvement of non-musical feedback can partially overcome the problem.

The nature of collaboration can be guided by the design of the available interfaces as well as software that uses participant inputs to determine compositional changes. However manipulating musical structures parametrically can be an abstract concept that is difficult to convey through current expressive interface designs.

Larger audience sizes are difficult; however multi-user control can be successfully applied to certain musical roles. Percussive devices in particular contribute many audible layers to the music are thus useful when dealing with large audiences.

Separate steams of audio for each interface are needed to enhance musical intercommunication and cognition of gesture-sound relationships.

REFERENCES

[1] MMA, *Midi Manufacturers Association*: MMA 2005. website: http://www.midi.org accessed: 29th of January 2005

[2] Wooller, R., *Researching and Developing Software for Live Electronic (Dance) Music*, thesis: *Creative Industries: Music*, Queensland University of Technology: Brisbane. 2003.

[3] Wooller, R., *LEMu: Live Electronic Music*, Brisbane: LEMu 2004. website: http://www.lemu.org accessed: 16th of April 2004

[4] Hopwood, G., *Handook of Art*, North Balwyn, Victoria: Graham Hopwood. 1971. 143.

[5] Shakel, B., *Human Factors and Usability*, in *Human-Computer Interaction: Selected Readings*, J. Preece and L. Keller, Editors, Prentice Hall. 1990.

[6] Isaacs, D., *Evaluating Input Devices for Musical Expression*, thesis: *The Department of Information Technology and Electrical Engineering*, University of Queensland: Brisbane. 2003. p. 18, 25.

[7] Priest, G., W. Marynowsky, and E. Stewart, *Electrofringe*, Newcastle: Octapod 2004. website: http://www.electrofringe.org/ accessed: 30th of January 2005

[8] Weinberg, G. *Interconnected Musical Networks*. in *Australasian Computer Music Association Conference*. Edith Cowan University, Perth: ACMC. 2003.

[9] Newton-Dunn, H., et al., *Block Jam* 2005. website: http://www.csl.sony.co.jp/IL/projects/blockjam/ accessed: 30th of January 2005

[10] Propellerheads, *Reason*, Stockholm: Propellerheads 2003. website: http://www.propellerheads.se accessed: 16th of April 2004

[11] O'Connell, J., *MIDI Yoke Junction*: Midi OX 2003. website: http://www.midiox.com/myoke.htm accessed: 29th of January 2005

[12] Interlink, *Force-Sensing Resistor Datasheet*: Interlink-Electronics 2005. website: http://www.interlinkelec.com/documents/datasheets/fsrdatasheet.pdf accessed: 29th January 2005

[13] Microchip, *PIC16F88 Microcontroller*: Microchip 2005. website: http://ww1.microchip.com/downloads/en/DeviceDoc/30487c.pdf accessed: 31st of January 2005

[14] NVLSI, *Nordic Semiconductor nRF2401A ultra low power 2.4GHz transceiver*: NVLSI 2005. website: http://www.nvlsi.no/ accessed: 28th of January 2005

[15] Eltham, B. and S. Joslin, *Straight Out of Brisbane Festival*, Brisbane: SOOB Festival inc 2005. website: http://www.straightoutofbrisbane.com/ accessed: 30th of January 2005